



**International Benchmark Study  
on Numerical Simulation Methods for the Prediction of  
Added Resistance and Manoeuvrability of Ships in Waves**

**Call for Participation**

**Introduction**

The 2012 guidelines on the method of calculation of the attained Energy Efficiency Design Index (EEDI) for new ships, MEPC.212(63), represent a major step forward in implementing energy efficiency regulations for ships through the introduction of the EEDI limits for various types of ships. There are, however, serious concerns regarding the sufficiency of propulsion power and steering devices to maintain manoeuvrability of ships in adverse conditions, hence regarding the safety of ships, if the EEDI requirements are achieved by simply reducing the installed engine power. To address the challenges of this issue by in-depth research studies, a new European research project called SHOPERA (Energy Efficient Safe SHip OPERATION) [1], funded by the European Commission in the frame of FP7, was launched in October 2013, aiming at developing suitable methods and tools and systematic case studies which will enable the development of improved guidelines and their submission for consideration to IMO-MEPC in 2016.

Numerical simulation methods (on simulating the manoeuvrability of a ship in waves) of varying complexity, such as simplified formulas, potential flow methods, motion simulators and viscous field methods, will be compared with each other and with model tests for selected cases. As the employed methods are of varying complexity and capability, their robustness in predicting is expected to be accordingly of mixed quality. Within this context, an open *blind* international benchmark study is being organized by SHOPERA using for validation selected tank tests, which were conducted within the SHOPERA project. The aim of this benchmark study is to assess the accuracy/reliability of current numerical simulation methods worldwide and the international State-of-Art in the study field. The SHOPERA benchmark study will be jointly organized by NTUA-SDL and UDE-ISMT. The present study is conducted in the frame the European Project SHOPERA (Grant agreement no: 605221).

## Objectives

This study aims to contribute to the international state of the art in the operation of ships in adverse sea conditions by:

- I. recording numerical simulation methods employed at international level for the prediction of the added resistance (including drift forces) and maneuverability of ships in waves, and
- II. assessing the current level of accuracy and efficiency of the relevant numerical prediction methods by comparison with model experimental data.

## Approach

In this study the following approach will be applied:

- i. The participants will formally register for the benchmark study (until Nov. 30, 2015).
- ii. Registered study participants will receive the study data details.
- iii. The test cases will include a series of loading and operating conditions for the studied ships which will be simulated with the registered codes; there will be the option for the participants to not cover the whole set of test cases; results will be submitted to the coordinator until March 10, 2016.
- iv. The simulation results will be analyzed by the benchmark study coordinator and compared with corresponding model experimental data to conclude on the accuracy and efficiency of the methods. The outcome of the study will be presented at a public workshop on April 15, 2016, London.
- v. After the workshop, results of the benchmark study will be publicly available on SHOPERA's web site <http://www.shopera.org>. The outcome of the study will be submitted for consideration to IMO. Also, results of the benchmark study will be published in relevant international conferences and peer reviewed journals.

## Study Particulars

- 1) Two (2) vessel types of different characteristics are selected for the benchmark study: the KVLCC2 tanker designed by MOERI (see Gothenburg Workshop on CFD [2]), and the Duisburg Test Case (DTC) container vessel designed by the University of Duisburg-Essen as described by el. Moctar et.al. [3];
- 2) The scope of the present benchmark study is focused on
  - a. the prediction of the added resistance and drift forces of ships in regular waves (of various wave lengths and headings) and
  - b. the simulation of turning circle and zig-zag maneuvers in regular waves.For such conditions corresponding experimental measurements will be available and will be used in the comparisons;
- 3) Ship model data and experimental conditions will be provided to the study participants;
- 4) The full set of the experimental data used for the benchmark will be provided to the participants after the completion of the submission of the results by the study participants;
- 5) Communication with the participants, downloading of data and reports will be done through email/SHOPERA web site.
- 6) The simulation results will be treated anonymously and no commercial promotion of codes will be allowed.
- 7) The study is conducted for the scientific interest of the academic maritime community and the practical interest of the maritime industry.

## Organization of Study

NTUA-SDL and UDE-ISMT will be jointly in charge of this study. They will be supported by MARINTEK and IST and be responsible for:

- Coordination NTUA-SDL
- Benchmark specification NTUA-SDL, UDE-ISMT, IST, MARINTEK
- Provision of ship and experimental data NTUA-SDL, UDE-ISMT, MARINTEK
- Analysis of the simulation results UDE-ISMT, NTUA-SDL
- Reporting of the study NTUA-SDL, UDE-ISMT
- Preparation of submission to IMO NTUA-SDL

The study participants will be responsible for:

- Numerical predictions and timely submission of results
- Verification of their results in collaboration with the study coordinator
- Contribution to the analysis and evaluation of the results

## Time Plan

Call for participation	3 Nov 2015
Confirmation of participation	30 Nov 2015
Provision of study data	10 Dec 2015
Submission of results	10 Mar 2016
Preliminary analysis	30 Mar 2016
Presentation of Results	15 Apr 2016

## Participation

Participation to the benchmark study can be requested through the SHOPERA web site or directly by email to the study coordinators:

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## References

- [1] SHOPERA (2013-2016), <http://www.shopera.org>
- [2] Proceedings of the Gothenburg Workshop on CFD in Ship Hydrodynamics, 2010.
- [3] el Moctar, O., Shigunov, V., Zorn, T., “Duisburg Test Case: Post-Panamax Container Ship for Benchmarking”, Journal of Ship Technology Research, Vol.59, No.3, pp. 50-65, 2012.